APPENDIX A

UTAH'S FOREST WATER QUALITY GUIDELINES

Pre-harvest Planning

Pre-harvest planning is the design of timber harvest operations to meet landowner objectives.

Application Practices

1. Contact or consultation with a professional forester. When site conditions dictate, other resource professionals should be consulted.

2. Have a forest management plan, forest stewardship plan, timber harvest plan, prescribed burning plan or other appropriate plan prepared. Include a list of specific Forest Water Quality Guidelines applicable to the site and the proposed activities.

3. Locate environmentally sensitive areas utilizing field observations, aerial photographs, topographic maps and other available maps and resources. This may include areas such as streams, wetlands, lakes, unstable soil areas, special plant and wildlife areas and steep slopes.

4. Locate and mark streamside management zones (SMZ). Steamside management zones should be located in the field and managed according to site specific needs. Any stream crossings should carefully located and disturbance within the SMZ should be minimized (see Streamside Management Zone).

5. Choose the appropriate harvest prescription such as thinning (even or uneven aged), shelterwood, seedtree, clearcut, etc., to achieve objectives and provide for desired future conditions.

6. Identify the appropriate harvesting system such as a rubber tired skidder, crawler, skyline and cable system, mechanical harvesting or helicopter for the existing and desired site conditions.

7. Plan the road layout. A carefully planned road system will provide for post-harvest access if desired, decrease sediment, reduce soil disturbance and allow for a more efficient harvest.

8. Locate log landings, haul roads, and major skid trails prior to start of any work.

9. Establish and designate vehicle and machinery maintenance areas. These areas should be limited in number and located to prevent contamination of streams and wetlands by petroleum products and other chemicals.

10. The location of logging camps should be carefully chosen to avoid adverse impacts to sensitive areas from human activities.

11. Plan for the treatment of slash, closure of roads and forest regeneration prior to harvesting.

12. Plan to conduct operations using a legally binding document that specifies what is to be harvested, slash disposal, site reclamation and the utilization of water quality protection measures. Consider the inclusion of contract guarantees such as performance bonds or provisions. Additionally, landowners should consider including provisions specific for their protection.

13. Obtain all necessary permits and approvals prior to initiation of activities.

Streamside Management Zone

The Streamside Management Zone (SMZ) is an area or strip of land adjacent to a stream or other body of water where management practices (e.g., harvesting of timber, road construction, prescribed burning, etc.) are designed to protect water quality, aquatic wildlife and wildlife habitat. The trees and vegetation within the SMZ serve as a natural filter to keep sediment out of a stream, reduce soil erosion and act as a buffer to protect the stream from degradation caused by nearby activities. The SMZ is **not** a zone of exclusion where all silvicultural activities are precluded but, because of its values, the SMZ is an area where management activities should be closely managed.

Classification categories used in determining a SMZ are:

Class I Streams: or other bodies of water used for domestic water supply and/or the spawning, rearing, migration of fish, including impacted streams with recovery potential for a fishery. Also included are perennial streams that contribute significant flow to downstream fisheries.

Class II Streams: All streams that do not meet the Class I definition and are identifiable in the field as having a defined channel bed of bed rock, sand, gravel, or rocky material, definite banks, generally having an ordinary high water mark and confines and conducts continuously or intermittently flowing water. Also included are reservoirs, lakes, and ponds greater than 1/10th of an acre that do not support fish or provide domestic water supply.

Application Practices

1. Designate the SMZ in the harvesting area based on the Stream Class and the percent of slope adjacent to the stream. Use the following zone distances.

Stream Class I:	Recommended minimum slope distance from the ordinary high water marks on each side of the stream is 75 feet.
Stream Class II:	Recommended minimum slope distance from the ordinary high water marks on each side of the stream is 35 feet.

In addition, the zone width should be increased in the following areas:
The width of the SMZ should be extended to include: 1) wetlands adjacent to the stream channel and 2) wetlands intercepted by the prescribed SMZ boundary (see Forest Wetlands).

Where slopes adjacent to the stream are greater than 35%, it is recommended that the SMZ include the area encompassed by the following minimum slope distances on each side of the ordinary high water mark:

- Stream Class I: 100 feet
- Stream Class II: 50 feet

2. Establish an "undisturbed strip of at least 15 feet slope distance on either side of the stream beginning at the ordinary high water mark. In this zone there would be no disturbance to vegetation or soil to maintain sufficient ground cover to trap sediment and to protect root mass for bank stability.

3. Trees are important to a healthy SMZ. Leave hardwoods, unmerchantable conifers and shrubs for bank stabilization and as a future source of large woody debris to the stream channel. Along perennial streams, it may be desirable to leave selected, healthy, merchantable trees and promote the retention of long lived species.

4. Shading requirements may dictate independent criteria for tree retention. Leave sufficient trees and shrubs to provide adequate shade for stream.

5. Clearly mark the SMZ boundary with flagging, paint or signs to ensure that equipment operators and tree cutters have no question about the boundary.

6. Minimize disturbances that expose mineral soil on the forest floor in the streamside management zone.

7. Avoid clear cutting (removing all or most of the trees) in the SMZ. Clearly mark those trees to be harvested in the SMZ.

8. When trees are removed from the SMZ, it is recommended that a diversity of tree species and age classes are maintained unless management goals state some different requirement.

9. In the SMZ, leave an adequate number of mature trees to avoid potential regeneration problems.

10. Maintain or provide sufficient ground cover and understory in the SMZ to trap sediment.

11. Directional felling or use of a boom feller-buncher is recommended for harvesting operations in the SMZ or wetlands. Cable-assisted felling techniques can reduce loss to breakage and further protect the SMZ. Keep slash (tree tops, branches) from entering streams, lakes or other bodies of water. Avoid felling trees in streams or bodies of water. Limbing of trees should be done above the high-water mark of the channel.

12. Avoid driving heavy equipment and skidders in SMZ. Utilize end-lining skidding technique to remove trees from the SMZ. When absolutely necessary, operate equipment only during frozen or dry ground conditions in SMZ.

13. Restrict mechanical site preparation in the SMZ. Encourage natural revegetation, seeding, and hand planting in SMZ.

14. All new or reconstructed roads, landings, portable sawmills, camps, skid trails, and fire lines should be located on stable areas outside the SMZ. Stream crossings and fire lines may be an exception when carefully implemented.

15. At all road crossings of Class I and II streams, structures should be sized to allow for full surface flow of the stream throughout the entire life of the structure. Design of stream crossing should be based on how long the structure is expected to be in place, acceptable risk level and downstream resources. Consider 50 year - 24 hour design peak flows for permanent structures. All structures for Class I streams should be designed and constructed to allow unrestricted fish passage (see stream crossing guideline in Road, Trails, Landings and Stream Crossings).

16. Plan stream crossings to avoid indiscriminate crossings. Cross stream at right angle (perpendicular) to channel. Minimize number of stream crossings to reduce bank impacts, sedimentation, and debris from entering the stream.

17. Do not side-cast soil or gravel into a stream, wetland or watercourse during road construction, grading or maintenance.

18. Wheeled or tracked equipment should not operate within the stream channel, draws, or the SMZ except on established roads. Do not skid down stream channels and draws.

19. Avoid the introduction of slash into the SMZ from adjacent areas. Avoid piling and burning slash in the SMZ (see Prescribed Fire).

20. Carefully control skid patterns to avoid on-site and downstream channel damage, buildup of destructive runoff flows, and erosion in sensitive watershed areas such as meadows and the SMZ. Use end-lining to winch logs directly (shortest distance) out of the SMZ.

21. Any material which inadvertently or accidentally enters a stream course in an amount which adversely affects the natural flow, water quality, or fishery resource, should be removed in a manner which causes the least disturbance. Logging debris, especially small limbs and needles, that can reduce oxygen levels in the water are of particular concern. However, some large material (large organic debris) can be essential for long term channel stability.

22. Excavated material removed from stream courses as a result of necessary construction should be moved to an upland area and stabilized where it will not be washed back to the stream during runoff. Short term stockpiles should be bermed and stabilized with mulch, erosion netting or erosion mats as necessary. If practical, permanent piles should be shaped to minimize sideslopes and contoured to blend with existing topography. Permanent piles should also be promptly stabilized using revegetation techniques.

23. Avoid broadcast burning (allowing fire to spread through an area) in the SMZ unless planned and identified as the proper management treatment (see Prescribed Fire).

24. Do not handle, store, apply, or dispose of hazardous or toxic materials (fuels, pesticides and herbicides) in a manner that could pollute the stream or wetlands or causes damage or injury to humans, lands, animals, or plants. Limit pesticide and fertilizer use in the SMZ unless labeled for such use. Establish a buffer for pesticide application along all flowing streams (See Chemical Management).

25. Do not mix or clean equipment or containers used for mixing or application of fuels, pesticides or herbicides near streams, bodies of water or in the SMZ (see Chemical Management).

Roads, Skid Trails, Landings and Stream Crossings

A **road** is a course of travel used for forest access. It may be used primarily or only occasionally for transportation of forest products. Roads may be either permanent or constructed in a manner intended to be temporary.

Skid trails are those areas used for the temporary transport of logs either by skidding or vehicle transport. These areas are usually excavated or denuded of vegetation by the repetitive use of a particular corridor.

Landings are those areas cleared of vegetation and sometimes excavated to facilitate the orderly stacking, decking, loading or bunching of logs in preparation for transport. Landings may include areas where logs are limbed and bucked if those areas are different from the areas where logs are decked or loaded.

Application Practices - Planning for Roads

1. Plan roads to fit within transportation networks and minimize road construction. Keep the number of roads to be built at a minimum. Bear in mind the impact upon visual quality of numerous roads. Provide standards to allow construction of roads which maintain forest productivity as well as protect water quality and fish and wildlife habitat.

2. Roads should be planned with safety in mind. Plan for road construction to the required standards for the intended purpose. Keep the roads no wider than necessary for safety and the intended use to minimize the disturbed area. Match the standards of road construction to the local site, terrain, soil conditions and topography as well as expected size of vehicle use.

3. Plan road location to avoid wetland areas where feasible. Temporary or permanent forest roads for silvicultural operations may be constructed without regulation by section 404 of the Clean Water Act if the 15 federally mandated Best Management Practices (BMPs) cited within the Concerns and Implications section of the Forest Wetland FWQG are implemented (see pg. 91). However, failure to utilize these BMPS or a future non-silvicultural use of the road to be constructed will require that a section 404 permit be applied for from the U.S. Army Corps of Engineers. Non-silvicultural uses include land conversion from forest to agricultural, residential/recreational development or other uses.

4. Plan roads which fit the natural terrain as much as possible. Minimize cuts and fills and where necessary, balance required fills with the amount of material to be excavated.

5. Locate roads upslope of natural drainages to allow road surfaces to drain.

6. Plan roads to avoid sustained excessive grades (10% to 20%).

7. Design road surface slope to utilize natural drainage (i.e., insloping, outsloping or changing of the grade).

8. Locate placement of dips, water bars and changes of road alignment to direct water off road surface. Use an appropriate number and spacing of dips and water bars based on grade of the road and soil types.

9. Design cross culverts or ditches to complement natural drainage for protection of the road surface, excavation or embankment.

    a. Locate cross culverts where fill erosion will be minimized and direct discharge into streams will be prevented.

    b. Road drainage structures should be spaced so peak flows between the features will not exceed the capacity of the individual drainage structures or result in excessive erosion of ditches and roadbeds.

10. Identify geologically stable areas to place excess excavated material.

11. Identify unstable areas and avoid road construction in these areas, if possible. An example might be where rock layers slant with the slope, rather than into the slope and represent potential for mass movement of rock and dirt. Obtain expert advice in these areas.

12. Plan stream crossings to avoid indiscriminate crossings. Cross stream at right angle (perpendicular) to channel and design approaches to prevent sediment transport onto roadfill. Minimize number of stream crossings to reduce bank impacts, sedimentation, and debris from entering the stream. Avoid more than one crossing point for the area harvested, if possible.

13. Design crossings to handle peak runoff and flood waters, minimize impact on water quality and provide adequate fish passage where appropriate. Design of stream crossing should be based on how long the structure is expected to be in place, acceptable risk level, and downstream resources. Generally, use of the 25 yr. - 24 hr. storm event for temporary road crossings and the 50 yr. - 24 hr. storm event for permanent road crossing will provide

adequate structure sizing. Remember stream crossings may require a stream alteration permit from the Utah Division of Water Rights.

14. Select the most appropriate feature for stream crossings,(i.e. fords, culverts or bridges) considering the following criteria: stream size, impact on aquatic resources, cost, maintenance requirements, permanence of crossing, stream banks and soil conditions of approaches.

    a. Fords may be the least expensive alternative if conditions allow. Limited traffic, type of stream bed, weight of vehicles using ford and season of use should all be considered when contemplating a ford stream crossing. Fords may be the most practical alternative in areas prone to flash floods. Fords do, however, cause continued disturbance to the stream bed. If a culvert or bridge is not practical, locate fords on stable, rocky portions of the stream channel. Fords may be improved to reduce stream bed damage by the use of such items as concrete planks or other similar materials. Fords should be considered as temporary crossings with low frequency of use. Use particular care to prevent the stream from being diverted onto the road surface by the ford.

    b. Culverts are the most common stream crossing structure. They are relatively inexpensive, allow use of native fill material and can be quickly installed. Permanent culverts should be of sufficient size for runoff (see # 13 above) and at least 15 inches in diameter, even those used for seeps, springs, wet areas and cross ditches. Culverts larger than 6 feet in diameter should be designed by an engineer or stream hydrologist. Fish passage should be provided for all Class I streams and other live streams as needed. Removal of temporary culverts requires excavation of fill material, extraction of the culvert and stabilization of the stream banks.

    c. Bridges usually have less impact on water quality and fisheries. Bridges are especially appropriate when crossing large streams or when debris is a problem. While usually more expensive, bridges can be permanent or temporary. Temporary bridges are easily placed and removed, relatively inexpensive, provide excellent stream protection, and usually require minimal stream bank rehabilitation. In addition, they can be reused.

Application Practices - Road Construction

1. Time road construction activities to limit operations during periods of excessive moisture or frozen ground.

2. Install road drainage at time of construction. Roads should be constructed in such a manner that debris, overburden and excess material are kept from entering streams. Drainage ways should be kept free from such material.

3. All road fills should be compacted to settle the fill material and reduce water entry into the fill. Snow, ice, frozen soil and woody debris should not be buried in fills. This could lead to development of voids in the fill and may lead to subsequent failure of the road. This is particularly important near streams.

4. Use rip rap, vegetative material, down spouts or similar devices to reduce erosion on fills.

5. If possible, maintain live trees and shrubs at the base of fill slopes to serve as sediment filters.

6. Construct slash windrows at the toe of fill slopes on stream crossings (upstream and downstream) to act as a filter and prevent sediment from entering streams.

7. Where potential for sediment delivery to a channel exists, construct slash windrows at outlets of relief culverts, cross drains, water bars, rolling dips and at the toe of fill slopes.

8. Construct roads to provide adequate drainage from the road surface by using outsloped or insloped roads with the appropriate ancillary features to reduce erosion.

    a. Outsloped roads allow water to drain off the road in a low-energy flow but require fill to be stable. This type of road is not appropriate in proximity to streams and must be evaluated for safety reasons.

    b. Insloped roads require a drainage ditch on the inside of the road to carry the water away from the cut bank and roadside. The gradient of such ditches must be carefully constructed. Ditch gradients of 2 to 6 percent are steep enough to keep collected water moving but not so steep that excessive erosion occurs. These ditches must then be allowed to drain away from the road at appropriate intervals along the road. This drainage may be accomplished by culverts, dips, water bars or cross drains.

9. Dips and water bars are constructed to effectively provide surface flow off the road. They should be built so that traffic does not obliterate them. Construction should be such that the proper drainage is provided but no driving hazard is created. The cross grade should be 2 or 3 percent at 90 degrees to the road centerline to minimize vehicle stress. Dips are usually the most economical way to provide cross road drainage.

10. Culverts are sometimes used to provide ditch relief for insloped roads. Culverts should be skewed 15 to 30 degrees toward the inflow of the ditch to optimize inlet efficiency and reduce maintenance problems. Protect the upstream end from plugging by armoring with rock or the use of drop inlets, boxes or screens (if appropriate). If possible, install these culverts at the gradient of the original ground slope. If not, the culvert outlets should be armored with rocks, logs or other material to dissipate the energy of the emerging water.

11. Avoid constructing a berm that may channel water down the road.

12. As soon as practical following construction, road cuts, fills and associated disturbed areas, should be stabilized and/or revegetated (e.g. backslope cut slopes as needed for stability). Natural revegetation may be adequate to stabilize these areas, however, seeding, hydro mulching or other revegetation may be necessary.

13. Surfacing of long term or permanent roads may be advantageous. This type of treatment includes graveling, covering with road base, chipping or pavement. Advantages of such treatment include less maintenance required, less transport of sediment, less road damage in wet periods and the extension of operating seasons.

14. Surfacing or other such treatment of short term roads on highly erodible areas such as switch backs and short sections of steep grades or other sensitive areas (e.g. stream crossings) reduces the opportunity for erosion and should be considered.

Application Practices - Stream Crossings

1. Construction activities should be timed to minimize impact to water quality. Usually this is late summer when water flows are minimal. However, thunderstorm activity and fisheries must be considered. Stream crossings should be emplaced as quickly as possible to limit adverse impacts. De-watering of sites by diversion through temporary culverts or the use of hose should be considered when installing culverts.

2. Use fords when appropriate. See section on fords under road planning. Fords require rocky stream beds or some type of armor plating to protect the bed.

3. To function properly, culverts should be aligned with the natural stream channel. This alignment is critical. Any deflection from the stream channel will cause bank erosion. Culverts which are skewed are also more prone to plugging by debris.

4. Culverts should be placed slightly below the grade of the natural stream. This will avoid culvert outfall which could cause erosion of the stream bed or bank at either the intake or outlet of the culvert.

5. The bed for the culvert should be of the same slope as the natural stream channel and should be of rock-free soil or gravel. This will allow the even distribution of the load over the full length of the culvert.

6. The original channel of the stream should not be altered upstream from the culvert unless necessary to prevent blockage or protect the fill.

7. Compact the fill material around the culvert as backfill occurs. This will prevent seepage and failure of the culvert. The backfill material should be of finer materials and free of voids. Culverts should be covered with at least one foot of compacted fill material for culverts up to 36 inches in diameter and one third of their diameter for larger culverts.

8. Consider using trash racks or inlet grates where debris in catch basin may threaten the structure.

9. Protect culvert inlet and outlet against erosion by providing rock armor, logs, grass seeding or other suitable material. Observe the water flow in a newly-placed culvert and determine any need for additional armoring.

10. Compact and grade the approaches to a culvert to maintain a consistent road grade.

11. Temporary bridges require firm soil banks. Some cribbing may be necessary to provide additional support for the stream bank. Approaches can be constructed that will not create any sediment. Railway cars and wooden structures are sometimes used effectively for portable, temporary bridges.

12. As soon as practical upon completion of use, temporary stream crossings need to be removed, excess fill material excavated and deposited in a stable area, banks rehabilitated and bed of the stream restored to its original grade. In some instances it may be necessary to remove temporary crossings prior to the spring runoff.

13. Permanent bridges require solid foundations such as bedrock, or concrete abutments and should be engineered for the appropriate size, span and material of construction. Obtain expert advice for the design and installation.

Application Practices - Road Maintenance

1. Grade roads only as often as needed to maintain a stable road surface and to retain the surface drainage. Avoid grading any section of a road unless maintenance is required. Unnecessary grading just creates a source of sediment from the newly disturbed surface.

2. Avoid cutting the toe of cut slopes when grading roads or pulling ditches. Clean ditches only when needed.

3. If grading produces excess material, feather it out or haul it away. Avoid side-casting material into streams. If large amounts of excess material exist, haul them to safe disposal sites which are stabilized to prevent erosion. Avoid locations near streams where erosion will carry materials into a stream.

4. Retain the appropriate inslope or outslope of the road. Avoid leaving a berm that channels water down the road.

5. To reduce maintenance, avoid using roads during wet periods if such use will damage the road or negate the effects of the erosion control features.

6. Reduce dust by use of water, rock or other appropriate road treatments.

7. Maintain erosion control features by periodic inspection and maintenance. Inspections should be conducted following heavy storms. Maintenance may include cleaning dips and cross drains, repairing ditches, cleaning culvert inlets and cleaning culvert trash racks or inlet grates.

8. Upon completion of forestry activities, examine the actual need for continued road use and erosional stability. In a timely manner, close all roads that are unstable, erodible or may not be necessary.

    a. Block access to discourage vehicular access.

    b. Remove structures and restore approximate natural drainage.

c. Install water bars and broad based dips at appropriate intervals.

d. Scarify and revegetate where natural revegetation is inadequate.

Application Practices - Skid Trails

1. Design and locate skid trails and skidding operations to minimize soil disturbance. The use of designated skid trails is one way of limiting soil compaction and site disturbance.

2. In designing skidding methods and trails, consider longer skidding routes which will reduce disturbance due to temporary road construction. Usually, roads cause more soil disturbance and opportunity for erosion than skid trails.

3. Use a skidding method such as a cable system, rubber tired skidder, tractor, fellerbuncher or other equipment which is appropriate for the soil and terrain. Cable systems can be used on steeper slopes. Uphill skidding produces skid trails that diverge and spread water. Downhill skidding methods tend to create skid trails that converge and concentrate runoff downhill. Soils which are highly erosive, saturated, easily compacted or geologically unstable are situations which warrant careful consideration when selecting a skidding system and identifying constraints on the skidding.

4. Avoid skidding directly up and down steep slopes for long distances. If tractor skidding steep slopes consider excavating skid trails across the slope and winching to the trail. Cable yarding downhill may require additional measures (such as slash deposition) to prevent excessive erosion.

5. Locate skid trails away from natural drainage systems, avoid concentrating runoff and limit grade where possible.

6. Limit skidding during wet periods to minimize soil displacement and compaction.

7. Upon cessation of skidding operations, if the slope of an area is sufficient to cause concern, install appropriate water diversion devices such as cross ditches or water bars in skid trails to prevent channelization and erosion.

8. Seed or use slash to mulch exposed soils where erosion may become a problem due to slope, soils or other site-specific situations.

9. Skid trails should be located outside Streamside Management Zones (SMZ).

Application Practices - Landings

1. If possible, construct or locate landings with 3 to 10 percent slopes for proper drainage.

2. Locate landings away from natural drainage systems and divert runoff to areas where vegetation can serve as a filter.

3. When locating landings, avoid areas where skidding down and across drainage bottoms to the landing may be a problem.

4. Minimize the number and size of landings yet still accommodate a safe, economical operation. However on steep slopes, more numerous and smaller landings along roads reduce the need for extensive excavations. Consider skidding as loading occurs to minimize landing size.

5. Landings should be located outside Streamside Management Zones (SMZ) and at a sufficient distance to preclude future encroachment into the SMZ.

6. Upon termination of operations, recontour landings to the extent practical, treat excessive compaction and revegetate where natural revegetation is inadequate.

Application Practices - Winter Operations

1. Winter weather allows opportunity for low impact logging and even operations impractical in other seasons of the year in some sensitive areas such as wet meadows, high water table areas or other areas of soil erosion or compaction hazard.

2. Construct roads during warmer months to prevent frozen material being used in road fills or use compacted snow for roads or trails in sensitive areas. Roads of compacted snow may also be used for single-entry harvests or temporary roads.

3. Provide adequate surface and cross drainage for all roads before the winter season occurs.

4. Locate and mark existing culverts. Mark in such a manner that location will be visible even in deep snow and storm conditions.

5. Keep all drainages open and culverts unplugged.

6. Begin operations after ground is frozen or snow cover is adequate to prevent damage (usually 15 inches or more).

7. During cold weather, plow snow cover off roadway to facilitate deep freezing of the road grade leaving 2" to 3" of compacted snow to protect road surface. This provides tremendous strength but excessive or deep snow cover must be kept from road surface.

8. Plow away snow berm or provide breaks in snow berm to allow road drainage particularly as the spring thaw occurs.

9. Suspend operations when weather conditions change and preclude activity. For example, hauling should be limited to colder portions of the day since road surfaces deteriorate rapidly when thawing occurs.

10. When alternate freezing and thawing occur, snow cover should be kept on the roads to prevent thawing during the warmer periods.

11. Remove temporary stream crossings prior to spring runoff.

Timber Harvesting

Timber harvesting is the cutting and removal of trees for wood products or the cutting of trees to accomplish forest management objectives.

Application Practices - Harvesting Equipment

1. Layout skid trails prior to harvesting.

2. Utilize directional felling techniques.

3. Consider the use of mechanical harvesters and delimbers that may reduce soil compaction.

4. Exclude the use of ground based machinery within the streamside management zone. Trees to be harvested within the SMZ should be end lined or harvested utilizing a boom feller-buncher.

5. Limit whole tree skidding where excessive damage may occur to the residual stand.

6. Utilize cable harvesting systems or helicopter logging on steep slopes (generally in excess of 40%) where the use of wheeled or tracked machinery could cause excessive soil disturbance.

7. Choose the appropriate sized equipment that can adequately perform the operation required, minimize soil disturbance and compaction with the least damage to any residual stands.

8. Consider the use of low ground pressure equipment (floatation tires or tracked) on wetland areas.

9. Avoid the use of skidder blades for braking when descending steep slopes.

10. Consider use of animals or specialized equipment for skidding where site conditions warrant.

11. Avoid excessive soil compaction.

Application Practices - Winter Logging

1. Install adequate road or skid trail drainage prior to start of activities or the summer prior to harvesting.

2. Clearly mark culverts and other drainage structures to be visible in deep snow and keep all drainages open and culverts unplugged.

3. Compact skid trails in snow prior to skidding.

4. Prepare for thawing and expect temporary shut-downs.

5. Avoid road construction during winter months.

6. Consider harvesting wetlands and other sensitive areas during the winter months utilizing snow roads and snow skid trails.

Application Practices - Slash Management (see Prescribed Fire)

1. The need to burn slash may be reduced by lopping, crushing, scattering, chipping or adherence to pre-determined utilization standards. Alternative uses of substandard merchantable material (e.g. firewood, fence stays, etc.) may also reduce the necessity of burning slash.

2. Slash can sometimes be cut in such a manner as to leave all branches and foliage within a foot or two of the ground. Slash treated in this manner, unless excessive in overall quantities, can be left to impede surface water flow, aid nutrient recycling and to provide protection for reproduction.

3. Minimal amounts of slash can sometimes be crushed by skidding equipment thereby making piling and burning unnecessary. This can be done efficiently if operators are instructed to do so during skidding operations.

4. Sometimes firewood or other products can be sold or given away from areas where concentrations of slash exist. However, some supervision may be necessary to prevent scattering of piled slash which may reduce or eliminate the opportunity for efficient burning of the piles.
5. Use brush blades for the piling of slash to reduce the amount of soil in slash piles.

6. Retain small slash and brush for nutrient recycling, shade and soil retention.

7. Avoid piling of slash within the SMZ for disposal or burning.

8. Utilized prescribed fire according to a burn plan prepared by a knowledgeable fire professional and in accordance with laws and administrative rules.

9. Ensure best possible utilization to prevent excessive slash accumulations and waste of resources.

10. Select appropriate slash disposal treatment that minimize water quality impacts and reduce risk of insect infestations.

Application Practices - Regeneration

1. Retain a sufficient number of healthy trees with adequate crowns and good form for seedtrees or retention trees during seedtree, selection, shelterwood and thinning operations.

2. Scarify the soil only to the amount necessary to meet regeneration objectives.

3. Limit soil compaction or treat excessively compacted soil to obtain adequate regeneration or revegetation.

4. Locate skid trails to minimize damage to regeneration.

5. Avoid running equipment over advanced regeneration except were desired to thin or change composition. Consider end lining felled trees out of advanced regeneration.

Site Preparation, Regeneration and Revegetation

Site preparation is the use of mechanical, chemical or other means to prepare a site for regeneration of a forest. Regeneration is the reestablishment of a forest stand or the re-stocking of a residual forest. Revegetation may include regeneration, however it additionally covers the need for soil stabilization by the use of herbaceous plants especially on log landings, skid trails, roads and within streamside management zones.

Application Practices - General Guidelines

1. Utilize pre-harvest planning that addresses the harvesting method (thinning, shelterwood, single and group tree selection, patch clearcutting, clearcutting, etc.) in regard to regeneration.

2. Consult with a forester in the planning and decision making process prior to signing contracts or harvesting timber.

3. Choose appropriate equipment for the harvest of timber on sensitive areas, including wetlands, bogs, slide areas and steep slopes. Selection should consider effects of erosion, compaction, sedimentation of waterbodies, soil displacement and minimization of soil disturbance.

4. Close trails, roads and landings upon completion of harvest or when use is no longer desired.

5. Reduce the opportunity for invasion of noxious weeds by prompt revegetation with appropriate seed.

6. Install water diversion devices where needed to limit the erosion potential.

Application Practices - Site Preparation

1. Ensure slash disposal and treatment to prepare site for regeneration through use of fire and/or mechanical means.

2. Create optimal conditions for the regeneration on the site or within the residual stand through the use of fire, mechanical or chemical means.

3. Plan prescribed burning to accomplish objectives without causing excessive damage to soil or the residual stand.

4. Scarify soil only to the amount required by the species desired for regeneration.

5. Consider chemical site preparation instead of mechanical site preparation where possible to reduce soil disturbance.

Application Practices - Regeneration

1. Retain healthy trees of desired species, with sufficient crowns and good form for seed trees or retention trees during seedtree, shelterwood and thinning operations to provide quality regeneration from genetically superior seed sources.

2. Retain stocking levels suited to site moisture conditions. Dry sites or southern aspects may require retention of some trees to provide shade for regeneration. Shade will reduce soil moisture loss and reduce temperatures providing better conditions for regeneration.

3. Plant proper species for soil and site conditions when using artificial regeneration.

4. Use local seed source stock during artificial regeneration projects where possible.

5. Monitor regeneration survival and take necessary measures to promote the long term survival of regeneration that protects water quality and meets the landowners stocking objectives.

Application Practices - Revegetation

1. As soon as practical following construction of road cuts, fills and associated disturbed areas, these areas should be revegetated and/or stabilized. Natural revegetation may be adequate. If not, revegetation should be augmented by seeding, hydro mulching or other means. Upon termination of operations, landings should be recontoured to the extent practical and revegetated.

2. Stabilize exposed soil (including firelines) with proper seed mixtures for soil and site conditions. Minimize the use of fertilizers to amend the soil.

3. On steep slopes the use of straw mulch or logging slash may be needed to stabilize soil until establishment of grasses.

4. Following removal of temporary culverts and bridges, establish earth or straw dikes on stream banks and seed with proper seed mixtures.

5. Utilize a native herbaceous seed mixture suited to site conditions. Avoid seeding herbaceous vegetation where tree seedling establishment is desired unless erosive conditions warrant. Slash may be used to reduce erosiveness.

Chemical Management

Chemical management refers to the use of chemicals such as pesticides (herbicides, rodenticide, insecticides, fungicides, etc.), petrochemicals (oil, gasoline, diesel), antifreeze, fire retardants and fertilizers for forest management.

Application Practices - General Guidelines

1. Have a contingency plan to follow in the event of a chemical spill. This plan should include who to contact in the event of a spill and may include having absorbent or neutralizing materials on hand with literature that describes spill cleanup or containment procedures.

2. Transport and store chemicals in leak-proof, labeled containers.

3. Chemical storage containers and facilities should be located outside the SMZ.

4. Use impervious dikes or berms around storage tanks with a capacity adequate to contain the entire volume of the tank according to local regulations.

5. When possible mix chemicals and clean equipment only in areas that are part of the application site.

Application Practices - Pesticides

1. Follow label instructions, EPA guidelines, and state law when using pesticides. Use pesticide for target species according to label instructions.

2. Restricted-use pesticides should only be applied under the supervision of persons who are properly trained and licensed. Such pesticides pose considerable risk to persons and the environment if used improperly.

3. Apply chemicals during appropriate weather and season. The biology of a pest normally determines the time of year when it can be controlled, and attempted control at other times is unlikely to be effective. Other weather factors that should be considered include wind that can cause chemical drift, extreme heat that can cause chemical volatilization and drift, humidity, and precipitation. Always follow label instructions.

4. Avoid aerial or broadcast application of pesticides in SMZs unless chemical is specifically labeled for application over or near water. Utilize spot treatments where appropriate in an SMZ. Herbicide treatments in an SMZ should be done in a manner to avoid killing large amounts of vegetation.

5. Consider chemical site preparation instead of mechanical where possible to reduce sedimentation and other adverse impacts to water quality.

6. Pesticides should not be applied to surface waters directly, by drift, or by washing into water, unless labeled for such use.

7. Do not mix chemicals or clean equipment or containers in or near streams, water bodies or streamside management zones.

8. Mix the appropriate amount of pesticide needed. Dispose of excess pesticides according to label instructions and existing regulations.

9. Transport, store and apply pesticides using leakproof, labeled containers. Dispose of pesticide containers in an approved landfill or according to label instructions.

10. Prevent chemical backflow (siphoning) into the water source by using an air gap or reservoir between the water supply hose and mixing tank.

11. Inspect and service equipment frequently, paying particular attention to seals, hoses and calibration of metering equipment.

12. Keep records of the chemical used, amounts or rates, date applied, where used, weather or site conditions at the time of use and results.

13. Ensure pesticide use is warranted and use the least amount and lowest toxicity that will achieve desired control. Consider biological, cultural, manual and preventative means to reduce amounts of chemicals applied (use IPM - Integrated Pest Management).

Application Practices - Petrochemicals and Antifreeze

1. Do not drain used oil, fuel, or antifreeze onto ground. Dispose of properly at an approved disposal station.

2. Fuel and service equipment away from SMZs and avoid spillage.

3. Keep all fuel, oil, and antifreeze away from surface waters and away from areas where spilled material may enter or be washed into water.

4. Do not apply used oil on road surfaces for dust control.

Application Practices - Other Considerations

1. Minimize use of fertilizers. Limit fertilizer applications in SMZs. Fertilizer use should be based on indication of need from a soil test or plant symptoms.

2. Avoid aerial fire retardant and foam drops within streamside management zones.

3. Avoid locating retardant mixing and filling stations within the SMZ.

Prescribed Fire

Prescribed fire is the use of fire as a management tool for a specified purpose when conducted under specific conditions to attain the stated objective without unduly damaging or jeopardizing soil, existing desirable vegetation and water quality.

Application Practices - Prescribed burning or In Place *(In situ)* burns (may include broadcast burns)

1. A prescribed burn plan should be prepared by a qualified professional prior to any burning.

2. Burns should not be conducted within a streamside management zone or in proximity to perennial streams, lakes or reservoirs unless specifically required by a management objective.

3. Response of vegetation to fire should be forecast by knowledgeable persons to ensure expected outcome is consistent with the management objectives.

4. Weather conditions and fuel moisture content should be specified for a burn to accomplish the intended purpose and yet avoid excessive damage to the existing vegetation and soil. Soil moisture should be optimal to reduce impact of burn to residual desirable vegetation and micro flora and fauna.

5. Total consumption or kill of target species is usually not necessary for a burn to be successful.

6. Ignition should be conducted in a manner to accomplish the purpose of the burn yet minimize the impact of resultant heat to the site.

7. Precautions should be taken which are necessary to ensure control of a fire at all times or to limit the risk of fire escaping an area intended for burning. If a wildfire occurs and control of the wildfire dictates fire line construction, these guidelines should also be implemented.

    a. If fire lines are necessary, they should be constructed along contours as much as possible. When erosion could become a problem, control measures should be taken to minimize soil loss. These measures include but are not limited to the installation of water bars, spreader ditches and the reseeding of disturbed areas susceptible to erosion (see Revegetation guideline in Road, Trails, Landings and Stream Crossings).

b. If weather conditions and the burn warrant, fire suppression forces such as engines or crews should be kept available to respond if needed.

8. A contingency plan should be prepared to identify appropriate actions to be taken if a prescribed fire exceeds control parameters (area, size, flame lengths or rate of spread).

9. Personnel experienced and qualified in fire management techniques should plan and conduct burns, provide supervision or be asked to provide technical expertise to conduct a safe, efficient, minimal impact burn.

Application Practices - Burning of slash

1. The decision to burn slash should be made judiciously. Other alternatives exist which may accomplish the same purpose.

   a. The need to burn slash may be reduced by lopping, crushing, chipping or adherence to pre-determined utilization standards. Alternative uses of substandard merchantable material (e.g. firewood, fence stays, etc.) may also reduce the necessity of burning slash.

   b. Slash can sometimes be cut in such a manner as to leave all branches and foliage within a foot or two of the ground. Slash treated in this manner, unless excessive in overall quantities, can be left to impede surface water flow, aid nutrient recycling and to provide protection for reproduction.

   c. Minimal amounts of slash can sometimes be crushed by skidding equipment thereby making piling and burning unnecessary. This can be done efficiently if operators are instructed to do so during skidding operations.

   d. Sometimes firewood or other products can be sold or given away from areas where concentrations of slash exist. However, some supervision may be necessary to prevent scattering of piled slash which may reduce or eliminate the opportunity for efficient burning of the piles.

2. A prescribed burn plan should be prepared by a qualified professional prior to any burning.

3. Pile and burn or burn only that slash necessary to abate the problem for which the burning will be done. Some slash left on a area will provide protection and nutrients for the regeneration while excessive removal of slash will cause soil compaction, higher soil temperatures and increase soil erosion.

4. Avoid introduction of slash into the Streamside Management Zone (SMZ) from adjacent areas.

5. When appropriate, whole length tree skidding with delimbing and bucking done at landings may concentrate slash in limited areas. Slash is much easier to treat when concentrated is such a manner. In addition, any damage done to the soil by subsequent burning is more limited in size of area affected.

6. Conduct slash piling operations only when soils are frozen or dry enough to minimize compaction and displacement.

7. Slash piled for burning should be sufficiently free from dirt and other unburnable material as to allow efficient burning and piles that do not burn clean shall be further treated to abate the problem caused by such slash.

    a. Use brush blades on dozers when piling slash. Avoid the use of dozers with angle blades.

    b. Slash piles should be large enough to generate sufficient heat when burned to consume the accumulated debris.

8. Burns of piles should not be conducted within a streamside management zone or in proximity to perennial streams, lakes, reservoirs or intermittent drainages.

9. Slash on moderately steep slopes may be more appropriately burned without being piled since use of dozers on these steeper slopes may initiate erosion waterways.

10. Very steep slopes may preclude burning if erosion would result. Erosive soils would also warrant special consideration.

Forested Wetlands

Wetlands, as defined in federal regulations and laws are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Forested wetlands are wetland areas that are covered by or surrounded by trees or forests.

Application Practices

1. Avoid locating roads, trails and landings in wetlands.

2. Utilize mats or other similar devices to disperse loads when crossing wetland areas.

3. Conduct harvest activities in wetlands when the ground is frozen, covered with snow or during extended dry periods.

4. Locate, identify, and mark wetlands prior to the start of any forestry operations.

5. Keep open water free from slash.

6. Use only pesticides labeled for use in wetlands.

7. Do not fuel or service equipment in wetlands.

8. Avoid equipment operation in areas of open water, seeps and springs.

9. Utilize low ground pressure equipment (floatation tires or tracked) as necessary to minimize rutting and compaction.

10. Provide adequate cross-road drainage to minimize changes to natural surface and subsurface wetland flows.

11. Avoid creation of ruts in wetlands. Where possible skid around wetlands or endline felled trees out of wetland areas. Utilize slash or matts to reduce rutting when skidding through wetlands is necessary.

12. Avoid skidding through open wetland meadows and big game wallows.

13. Where possible divert runoff from roads, trails and landings to upland areas above wetlands to reduce silting of wetland areas.

14. Minimize soil disturbance and compaction in wetlands during the treatment of slash.